Famous names in rotor dynamics

Burt L. Newkirk

Burt L. Newkirk, 1876 to 1964, was, according to Don Bently, the first to describe the action of oil whirl properly. Others misdescribed it, which led people on a terrible tangent for many years.

Newkirk started his professional career as a mathematician and astronomer. He graduated from the University of Minnesota in 1897 with a B.A. and 1899 with an M.A. in Mathematics, during which time he spent three years as assistant in the observatory. He received his Ph.D. in Astronomy, summa cum laude, from the University of Munich in 1902. His thesis on the parallax of the ring nebula Lyra included the first time anyone had found the distance of a nebula. Following post-doctoral work at Göttingen University, Newkirk joined the Berkeley Astronomical Department at the University of California in 1903. He became Assistant at the Lick Observatory, east of San Jose, California in 1906.

While in California, Newkirk become interested in engineering and engineering problems. In 1907 he accepted an invitation to return to the University of Minnesota to teach mathematics to the engineering students. He was Assistant Professor at his alma mater until 1920, teaching both mathematics and mechanics. During these thirteen years, Newkirk studied Gyroscopic Mechanics and developed a series of lecture-demonstrations that were promoted to the public at the Chautauqua Institution, an educational center in southwestern New York State. He felt that the greatest benefit from his years at the university was the habit of working hard and persistently at difficult problems.

During a sabbatical year at the General Electric Research Laboratory in Schenectady, New York in 1920, he worked at eliminating roughness from the operation of turbine generators. This resulted in his return to the Research Laboratory, where he remained for the next 16 years, until 1937. During this time, he did theoretical work on special mechanical problems concerning turbine vibrations, critical speeds of shafts and lubrication, and "shirt-sleeve" work on instrumentation and the operation of the largest blast-furnace blowers yet built. In 1924, he developed an optical method for observing the orbiting of the end of a vibrating shaft.

It was here at the Research Laboratory that he successfully described the oil whirl phenomenon of a shaft as due to a component of the restoring force that is not directed towards the equilibrium position. He developed a special partially-grooved bearing, ending in a dam, with Grobel in 1934, that increased the loading and raised the threshold of whirling. Unfortunately, he did not take the next step of dividing the force by the motion to get dynamic stiffness, even though he had the exact data, the amplitude and phase information. This oversight allowed others to write static equations for stiffness that misled people for many years.

After he retired from General Electric in 1937, he returned to teaching, this time at Rensselaer Polytechnic Institute, in the new Department of Aeronautical Engineering. His work there developed into the field of Aeroelastic Dynamics, or Flutter. He was one of the first to apply the technique of high speed schlieren photography to study the flow in aircraft centrifugal superchargers.

Newkirk continued his involvement with industry, working with Pratt and Whitney in the summer of 1942 on improvements in aircraft engines. After his retirement in 1950, he became Professor Emeritus of Vibration Theory and Practice and a consultant to companies, such as Worthington Pump and American Blower, and the Air Force. During this time, he revisited the problem of oil whirl, noting that whirl could occur well below the first "critical" (balance resonance) speed, but he still did not use dynamic stiffness as part of his analysis.

Newkirk was a member of five professional societies, including Fellow of the American Society of Mechanical Engineers (ASME), Associate Fellow of the Institute of Aeronautical Sciences, American Academy for the Advancement of Science, and Astronomische Gesellschaft. He was honored by ASME in 1975 when they created an award in his name that recognizes people who have made a notable contribution to the field of tribology in research or development. Newkirk held nine patents. One led to the Gisholt balancing machine for automobile crankshafts.

As both a researcher and a teacher, Newkirk was a firm believer that the laboratory was a necessary teaching tool. The Rensselaer Board of Trustees noted, after his death, that "Dr. Newkirk was an inspiring and sympathetic teacher, a careful and perceptive research worker, and a lover of camping and outdoor life. He typified the finest traditions of the academic and scholarly life..."

References

1. Minnesota Alumni Weekly, various issues.
2. Minutes of the Board of Trustees of Rensselaer Polytechnic Institute, April 10, 1965.
3. Newkirk, B.L., Instability of oil films and more stable bearings, General Electric Company Research Laboratory, Schenectady, N.Y., No. 852, October 1937.

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